

THAT WHICH IS CLAIMED IS:

1. A tackifier resin comprising repeating units of at least one aromatic monomer and at least one acrylate monomer; wherein said tackifier resin has a low residual monomer concentration.
2. A tackifier resin according to Claim 1 wherein said aromatic monomer is at least one selected from the group consisting of olefinic substituted aromatics.
3. A tackifier resin according to Claim 2 wherein said aromatic monomer is selected from the group consisting of styrene, alpha-methyl styrene, vinyl toluene, indene, methylindenes, divinylbenzene, dicyclopentadiene, and methyl-dicyclopentadiene.
4. A tackifier resin according to Claim 1 wherein said acrylate monomer has the general formula:



wherein R_1 is selected from the group consisting of hydrogen, aliphatic groups, and aromatic groups; wherein R_2 is selected from the group consisting of hydrogen, aliphatic groups, and aromatic groups; and wherein R_3 is selected from the group consisting of hydrogen, aliphatic groups, aromatic groups.

5. A tackifier resin according to Claim 4 wherein said aliphatic group has 1 to about 20 carbon atoms.

6. A tackifier resin according to Claim 5 wherein said aliphatic group has 1 to 12 carbon atoms.
7. A tackifier resin according to Claim 4 wherein said aromatic group has about 6 to about 20 carbon atoms.
8. A tackifier resin according to Claim 4 wherein both R₁ and R₂ of said acrylate monomer are hydrogen.
9. A tackifier resin according to Claim 1 wherein said acrylate monomer is selected from the group consisting of methyl acrylate, acrylic acid, methacrylic acid, methyl methacrylate, ethyl acrylate, ethyl methacrylate, butyl acrylate, butyl methacrylate, isobutyl acrylate, isobutyl methacrylate, n-hexyl acrylate, n-hexyl methacrylate, ethylhexyl acrylate, ethylhexyl methacrylate, n-heptyl acrylate, n-heptyl methacrylate, 2-methylheptyl (meth)acrylate, octyl acrylate, octyl methacrylate, isooctyl (meth)acrylate, n-nonyl(meth)acrylate, iso-nonyl(meth)acrylate, decyl(meth)acrylate, isodecyl acrylate, isodecyl methacrylate, dodecyl(meth)acrylate, isobornyl(meth)acrylate, lauryl methacrylate, lauryl acrylate, tridecyl acrylate, tridecyl methacrylate, stearyl acrylate, stearyl methacrylate, glycidyl methacrylate, alkyl crotonates, vinyl acetate, di-n-butyl maleate, di-octylmaleate, acetoacetoxyethyl methacrylate, acetoacetoxyethyl acrylate, acetoacetoxypropyl methacrylate, acetoacetoxypropyl acrylate, diacetone acrylamide, acrylamide, methacrylamide, hydroxyethyl methacrylate, hydroxyethyl acrylate, allyl methacrylate, tetrahydrofurfuryl methacrylate, tetrahydrofurfuryl acrylate, cyclohexyl methacrylate, cyclohexyl acrylate, n-hexyl acrylate, n-hexyl methacrylate, 2-ethoxyethyl acrylate, 2-ethoxyethyl methacrylate, isodecyl methacrylate, isodecyl acrylate, 2-methoxy acrylate, 2-methoxy methacrylate, 2-(2-ethoxyethoxy) ethylacrylate, 2-phenoxyethyl acrylate, 2-phenoxyethyl methacrylate,

isobornyl acrylate, isobornyl methacrylate, caprolactone acrylate,
caprolactone methacrylate, polypropyleneglycol monoacrylate,
polypropyleneglycol monomethacrylate, polyethyleneglycol(400) acrylate,
polypropyleneglycol(400) methacrylate, benzyl acrylate, benzyl
5 methacrylate, sodium 1-allyloxy-2-hydroxypropyl sulfonate, acrylonitrile, and
mixtures thereof.

10. A tackifier resin according to Claim 1 wherein said acrylate monomer
has up to about 20 carbon atoms.

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11. A tackifier resin according to Claim 10 wherein said acrylate
monomer is selected from the group consisting of acrylic acid, 2-ethylhexyl
acrylate, methyl methacrylate, methyl acrylate, acrylic acid, methacrylic
acid, methyl methacrylate, ethyl acrylate, ethyl methacrylate, butyl acrylate,
15 butyl methacrylate, isobutyl acrylate, isobutyl methacrylate, n-hexyl
acrylate, n-hexyl methacrylate, ethylhexyl acrylate, ethylhexyl methacrylate,
n-heptyl acrylate, n-heptyl methacrylate, 2-methylheptyl (meth)acrylate,
octyl acrylate, octyl methacrylate, isooctyl (meth)acrylate, n-
nonyl(meth)acrylate, iso-nonyl(meth)acrylate, decyl(meth)acrylate, isodecyl
20 acrylate, isodecyl methacrylate, dodecyl(meth)acrylate,
isobornyl(meth)acrylate, hydroxyethyl methacrylate, hydroxyethyl acrylate,
allyl methacrylate, cyclohexyl methacrylate, cyclohexyl acrylate, n-hexyl
acrylate, n-hexyl methacrylate, isobornyl acrylate, isobornyl methacrylate,
and mixtures thereof.

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12. A tackifier resin according to Claim 11 wherein said acrylate
monomers are acrylic acid and 2-ethylhexyl acrylate.

13. A tackifier resin according to Claim 1 wherein said acrylate monomer contains at least one functional group selected from the group consisting of hydroxy, cycloaliphatic, acid, epoxide, amide, acrylonitril and acrylate groups.
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14. A tackifier resin according to Claim 1 wherein said tackifier resin is produced by a radical catalyzed polymerization process utilizing at least one initiator.
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15. A tackifier resin according to Claim 14 wherein said initiator is selected from the group consisting of diacyl peroxides, dialkylperoxidicarbonates, tert-alkyl peroxyesters, di-tert-alkyl peroxides, tert-alkyl hydroperoxides, ketone peroxides, and mixtures thereof.
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16. A tackifier resin according to Claim 1 wherein said tackifier resin is produced by a process comprising contacting a tackifier resin product stream with at least one carrier at a temperature sufficient to remove a portion of at least one residual monomer to produce said tackifier resin.
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17. A tackifier resin according to Claim 1 wherein said tackifier resin does not significantly decrease the moisture vapor transport rate of an adhesive composition containing said tackifier resin.
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18. A tackifier resin according to Claim 17 wherein said tackifier resin does not decrease said moisture vapor transport rate of said adhesive composition by more than 25% over said adhesive composition without said tackifier resin.

19. A tackifier resin according to Claim 17 wherein said moisture vapor transport rate of said adhesive composition is the same or increased over said adhesive composition without said tackifier resin.
- 5 20. A tackifier resin according to Claim 17 wherein said moisture vapor transport rate of said adhesive composition ranges from about 200 to about 3000.
21. A tackifier resin according to Claim 20 wherein said moisture vapor
10 transport rate of said adhesive composition ranges from about 500 to 1500.
22. A tackifier resin according to Claim 1 wherein said residual monomer concentration of said tackifier resin is less than about 600 ppm by weight based on the weight of said tackifier resin.
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23. A tackifier resin according to Claim 22 wherein said residual monomer concentration of said tackifier resin is less than about 300 ppm by weight based on the weight of said tackifier resin.
- 20 24. A tackifier resin according to Claim 23 wherein said residual monomer concentration of said tackifier resin is less than about 200 ppm aromatic monomer based on the weight of said tackifier resin and less than about 400 ppm acrylic monomer.
- 25 25. A tackifier resin according to Claim 24 wherein said residual monomer concentration of said tackifier resin is less than about 100 ppm by weight aromatic monomer and less than about 150 ppm by weight acrylic monomer.

26. A tackifier resin according to Claim 1 wherein said tackifier resin has a residual solvent concentration less than about 500 ppm by weight based on the weight of said tackifier resin.
- 5 27. A tackifier resin according to Claim 1 wherein the amount of aromatic monomer repeating units in said tackifier resin ranges from about 20% to about 70% based on the total amount of monomer repeating units in said tackifier resin.
- 10 28. A tackifier resin according to Claim 1 wherein the amount of acrylate monomer repeating units in said tackifier resin ranges from about 30% to about 80% based on the total amount of monomer repeating units in said tackifier resin.
- 15 29. A tackifier resin according to Claim 1 wherein said tackifier resin has a R&B softening point ranging from being a liquid at room temperature to about 180°C.
- 20 30. A tackifier resin according to Claim 1 wherein the acid number of said tackifier resin ranges from about 0 to about 300 mg KOH/g resin.
31. A tackifier resin according to Claim 1 wherein the hydroxyl number of said tackifier resin ranges from about 0 to about 300.
- 25 32. A tackifier resin according to Claim 1 wherein the MMAP cloud point of said tackifier resin is less than 50°C.
- 30 33. A tackifier resin according to Claim 1 wherein the number average molecular weight (Mn) of said tackifier resin ranges from about 1,500 to about 7,000 daltons.

34. A tackifier resin according to Claim 33 wherein said number average molecular weight (Mn) of said tackifier resin ranges from 2,000 to 4,000 daltons.

5 35. A tackifier resin according to Claim 1 wherein the weight average molecular weight (Mw) of said tackifier resin ranges from about 2,000 to about 25,000 daltons.

10 36. A tackifier resin according to Claim 35 wherein said weight average molecular weight (Mw) of said tackifier resin ranges from 3,000 to 10,000.

15 37. A tackifier resin according to Claim 1 wherein the z-average molecular weight (Mz) of said tackifier resin ranges from about 3,000 to about 75,000 daltons.

38. A tackifier resin according to Claim 37 wherein said z-average molecular weight (Mz) of said tackifier resin ranges from 5,000 to 20,000.

20 39. A tackifier resin according to Claim 1 wherein the Gardner color of said tackifier resin is less than 5.

40. A tackifier resin according to Claim 1 wherein said tackifier resin comprises monomer repeating units from at least one monomer selected from styrene, acrylic acid, and 2-ethylhexyl acrylate.

25 41. A tackifier resin according to Claim 40 wherein the amount of styrene repeating units ranges from 0.1% to 99.9% based on the total amount of monomer repeating units in said tackifier resin.

42. A tackifier resin according to Claim 40 wherein the amount of acrylic acid and 2-ethylhexyl acrylate ranges from 0.1% to 99.9% based on the total amount of monomer repeating units in said tackifier resin.

5 43. A tackifier resin according to claim 41 wherein the amount of styrene repeating units ranges from about 20% to about 70% based on the total amount of monomer repeating units in said tackifier resin, and the combined amount of acrylic acid repeating units and 2-ethylhexyl acrylate repeating units ranges from about 30% to about 80%.

10 44. A tackifier resin comprising repeating units of at least one aromatic monomer and at least one acrylate monomer; wherein said tackifier resin does not significantly decrease the moisture vapor transport rate of an adhesive composition comprising said tackifier resin.

15 45. A tackifier resin comprising repeating units of at least one aromatic monomer and at least one acrylate monomer; wherein said tackifier resin does not significantly increase fogging of an adhesive composition comprising said tackifier resin.

20 46. A tackifier resin comprising repeating units of at least one aromatic monomer and at least one acrylate monomer; wherein said tackifier resin does not significantly exhibit skin sensitivity properties.

25 47. A tackifier resin comprising repeating units of at least one aromatic monomer and at least one acrylate monomer; wherein said tackifier resin does not significantly decrease the moisture vapor transport rate of an adhesive composition comprising said tackifier resin; and wherein said tackifier resin does not significantly increase fogging of an adhesive composition comprising said tackifier resin.

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48. A tackifier resin according to Claim 47 wherein said tackifier resin does not significantly exhibit skin sensitivity properties.

5 49. A process to produce a tackifier resin, said process comprising contacting a tackifier resin product stream with at least one carrier at a temperature sufficient to remove a portion of at least one residual monomer from said tackifier resin product stream to produce said tackifier resin.

10 50. A process according to Claim 49 wherein said carrier is selected from the group consisting of steam, nitrogen and ethane.

51. A process according to Claim 49 wherein said contacting occurs at a temperature in a range of about 150°C to about 250°C.

15 52. A process according to Claim 49 wherein said contacting occurs at a pressure in a range of about 10 mbar to about 1000 mbar.

53. A process to produce a tackifier resin, said process comprising:
a) providing at least one aromatic monomer, at least one
20 acrylate monomer, and optionally at least one solvent to a reactor zone to produce a reaction mixture;
b) polymerizing said reaction mixture in the presence of at least one initiator to produce a tackifier resin product stream; and
c) contacting said tackifier resin product stream with a carrier to
25 remove a portion of at least one residual monomer from said tackifier resin product stream to yield said tackifier resin.

54. A process to produce a tackifier resin, said process comprising:
- a) providing at least one aromatic monomer, at least one acrylate monomer, and optionally at least one solvent to a reactor zone to produce a reaction mixture;
 - 5 b) polymerizing said reaction mixture in the presence of at least one initiator to produce a tackifier resin product stream;
 - c) heating said tackifier resin product stream at a temperature sufficient to remove a portion of at least one residual monomer from said tackifier resin product stream; and
 - 10 d) contacting said tackifier resin product stream with at least one carrier to further remove a portion of said residual monomer to produce said tackifier resin.
55. A process to produce a tackifier resin according to Claim 54 wherein said heating is conducted at a temperature ranging from about 150°C to about 250°C.
56. A process to produce a tackifier resin according to Claim 54 wherein said heating is conducted at a pressure in a range of about 10 mbar to about 1000 mbar.
57. A process to produce a tackifier resin, said process comprising:
- 25 a) providing at least one aromatic monomer, at least one acrylate monomer, and optionally at least one solvent to a reactor zone to produce a reaction mixture;
 - b) polymerizing said reaction mixture in the presence of at least one initiator to produce a tackifier resin product stream;

c) heating said tackifier resin product stream at a temperature in a range of about 150°C to about 250°C to remove a portion of the residual monomers from said tackifier resin product stream; and

5 d) contacting said tackifier resin product stream with a carrier to further remove a portion of said residual monomers to yield said tackifier resin having residual monomer concentrations of less than about 200 ppm of aromatic monomer and 400 ppm of acrylate monomer.

58. A process to produce a tackifier resin, said process comprising:

10 a) contacting at least one aromatic monomer, at least one acrylate monomer, and at least one initiator to produce a monomer-initiator stream;

b) routing said monomer-initiator stream to a reaction zone containing solvent at a temperature in a range of about 100°C to about 15 250°C;

c) polymerizing said monomer-initiator feed stream at polymerization conditions to produce a tackifier resin product stream;

d) optionally, providing an additional amount of initiator to said reaction zone;

20 e) heating said tackifier resin product stream at a temperature in a range of about 150°C to about 250°C and at a pressure of about 10 mbar to about 1000 mbar to remove a portion of said residual monomers from said tackifier resin product stream; and

25 f) contacting said tackifier resin product stream with steam at a temperature of about 150°C to about 250°C and at a pressure of about 10 mbar to about 1000 mbar to further remove said residual monomers to yield said tackifier resin having residual monomer concentrations of less than 200 ppm by weight of aromatic monomer based on the weight of said tackifier resin and 400 ppm of acrylate monomer based on the weight of
30 said tackifier resin.

59. A process of making an adhesive composition, said process comprising providing at least one tackifier resin and at least adhesive component wherein said tackifier resin comprises monomer repeating units from at least one aromatic monomer and at least one acrylate monomer.

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60. A process according to Claim 59 further comprising contacting said adhesive composition with at least one substrate to produce an article.

61. A process according to Claim 60 wherein said substrate is selected from the group consisting of polyethylene terephthalate, biaxially oriented polypropylene, woven fabrics, non-woven fabrics, metals, metal foils, paper, glass, ceramics, and composite materials comprising laminates of one or more of these materials.

62. A tackifier resin produced by the process of Claim 49.

63. A tackifier resin consisting essentially of the repeating units from at least one aromatic monomer and at least one acrylic monomer; wherein said tackifier resin has a low residual monomer concentration.

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64. A tackifier resin according to Claim 63 wherein said aromatic monomer is styrene.

65. A tackifier resin according to Claim 63 wherein said acrylic monomer is 2-ethyl hexyl acrylate and acrylic acid.

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66. An adhesive composition comprising said tackifier resin of Claim 1.

67. An article comprising said adhesive composition of Claim 66.

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